SUBSURFACE INVESTIGATION

FOR

PROPOSED SANITARY LANDFILL
PINE AVENUE AND 14TH STREET
NORTH CHICAGO, ILLINOIS

FOR

Tomlin Associates
23438 King Drive
Mt. Clemens, Michigan

BY

Soil Testing Services, Inc.
111 Pfingsten Road
Northbrook, Illinois 60062
STS Job No. 14043-B

SOIL TESTING SERVICES, INC.
111 PFINGSTEN ROAD NORTHBROOK, ILLINOIS 60062
PHONE Chicago 312-273-5440 Northbrook 312-272-6520

November 13, 1973

Tomlin Associates
23438 King Drive
Mt. Clemens, Michigan 48034

Attention: Mr. Thomas H. Handyside, P.E. STS Job No. 14043-B

Reference: Subsurface investigation for the proposed sanitary landfill at *Pine Avenue and 14th Street in North Chicago, Illinois*

Gentlemen:

We are submitting, herewith, the results of the subsurface investigation at the above mentioned site.

In summary, predominantly cohesive soils were encountered in the six borings performed at the site. With proper engineering design and operating procedures, the site could be employed for sanitary landfill purposes.

If there are any questions with regard to the information contained in this report, or if we can be of further service to you in any way, please do not hesitate to contact us.

Very truly yours,

SOIL TESTING SERVICES, INC.

Kegham Shiranian, P.E.
Supervising Project Engineer

James A. Cunningham, P.E.
Principal Engineer

Clyde N. Baker, Jr., P.E.
Chief Ergineer

KS:sk

cc: Browning-Ferris Industries, Wheaton, Illinois
Illinois Environmental Protection Agency, Permit Section

Enclosures

STS Job No. 14043-B
November 13, 1973

INTRODUCTION

Subsurface investigation for the proposed sanitary landfill to be located at Pine Avenue and 14th Street in North Chicago, Illinois, has been completed. Six (6) soil borings to depths ranging from 26.5 to 42 ft. below existing ground surface were performed at the site and the results of these borings, along with the location diagram, are included in the appendix of this report. Elevation of the borings, referenced from a bench mark located on top of concrete foundation (bottom of brick), SEC of North Shore Sanitary District Pump House (see location diagram) are included on the boring logs.

It is our understanding that the site investigated may be utilized for sanitary landfill waste disposal operations. Information regarding the development of this site is not available at this time, so that, the report presented herein should be considered preliminary in nature.

The purpose of this report is to describe the soil conditions encountered at the site, to analyse and evaluate the test data obtained, to describe the laboratory testing program and to submit preliminary comments relative to the development and manner of operation of thy proposed landfill.

SUBSURFACE INVESTIGATION PROCEDURES

The soil borings were performed with a truck mounted auger type drilling rig which uses continuous flight augers to advance the bore holes. Representative

soil samples were obtained by means of the split-barrel and shelby tube sampling procedures in accordance with ASTM Specifications D 1586 and D 1587, respectively (see appendix). All the soil samples recovered were identified and sealed in the field, and returned to our laboratory for further examination and testing.

In addition to the regular soil borings, observation wells consisting of 1-1/4 in. diameter PVC riser pipe and well point screens were installed at two of the boring locations. The locations and depth to which this observation wells were installed are indicated on the respective boring logs. The observation wells were installed by placing the well point in the soil boring hole and placing well graded sand around the well point itself for a height of about 5 ft. Bentonite pellets were placed above the sand and backfilled to the ground surface. These observation wells are for the purpose of providing a source of water samples for water quality analysis and for water level readings.

LABORATORY TESTING PROGRAM

The laboratory testing program consisted of performing water content, unit dry weight and hand penetrometer tests upon representative portions of the samples recovered from the split-barrel and shelby tube sampling procedures. In the penetrometer test, the unconfined compressive strength of the cohesive soil is estimated to a maximum value of 7 tsf by measuring the samples' resistance to penetration of a small, spring-calibrated plunger. The results of all tests performed are shown on the boring logs.

In addition, several representative samples were selected for permeability and grain size distribution tests. The grain size distribution tests were performed by means of combination sieve and hydrometer analysis, and the results of these tests are indicated on the grain size distribution curves included with this report. The permeability tests were performed on relatively undisturbed cohesive samples recovered from the shelby tube samplers by means of the constant head permeability test. The results of the permeability test indicate values on the order of from 2.1×10^{-7} cm/sec. to 9.2×10^{-7} cm/sec. A summary of the results of the permeability tests are also included in the appendix of this report.

A single cation exchange capacity test was performed on a representative sample of the clay recovered from the borings. The results of this test are included in the appendix of this report.

After completion of the testing program, the samples were visually examined in the laboratory and classified in accordance with the Unified Soil Classification system by experienced soil engineers and technicians. The estimated group symbol of the Unified Classification system is included in parentheses following soil descriptions on the boring logs and a brief explanation of this system of classification is included in the appendix of this report.

Soil samples will be retained in the laboratories of Soil Testing Services, Inc., for a period of 60 days, after which they will be discarded unless instructions as to their disposition are received.

SITE CONDITIONS

The majority of the site of the proposed sanitary landfill was vacant at the time of the subsurface investigation. Maximum topography relief across the site is on the order of 10 to 15 ft. and the ground surface generally slopes downwards to the west and northwest. The portion of the 7.5 minute USGS topography map of the area, with the site indicated, is included in the appendix of this report.

SOIL CONDITIONS

The specific soil conditions encountered at each individual boring location are indicated on the respective logs. The stratification represents the approximate boundaries of the different soil types; in situ, the transition may be gradual.

As indicated on the boring logs, from 1 ft to 2 ft. of silty clayey topsoil was encountered overlying the site at the boring locations. Below the topsoil, generally tough to hard silty clay soils with varying percentages of sand and gravel were encountered extending to the maximum depth of the borings performed. However, in the majority of the borings, pockets and layers of predominantly granular soils, such as silty fine sand, fine sand, fine to medium sand, silty clayey sand and silt with varying percentages of clay and sand were encountered in the silty clay soil mass. These more permeable layers were noted at varying depths below the existing ground surface.

In summary, in boring B-1, silty clayey fine to medium sand, silt and silty fine sand were encountered at 5 ft. below existing ground surface and extending to 18 ft. below ground surface. In boring B-2, a 2 ft. layer of fine sand was encountered at 8 ft. below ground surface, and 3 ft. layer of fine to medium sand was encountered at 21 ft. below ground surface. In boring B-3, silty fine to medium sand and clayey silt was encountered at 5 ft. below ground surface and extending to 10 ft. below ground surface. In boring B-4, silt with trace of sand and gravel with layers of sand and gravel were encountered at 10 ft. below ground surface and extending to 20 ft. below ground surface. In boring B-5, silty fine sand, silt and clayey silt were encountered at 5 ft. below ground surface and extended to 13 ft. below ground surface. In boring B-6, silt with trace of clay and sand, fine sand and silty and clayey sand were encountered at 8.5 ft. below ground surface and extended to 24 ft. below ground surface. These granular soil inclusions may be continuous across the site.

GROUND WATER TABLE CONDITIONS

Water level readings were obtained during, immediately after completion of the borings and, in the wellpoint observation wells, at approximately 10 days after completion of the boring operations. These readings are indicated on the respective boring logs. These readings indicate the water level to be between 1 ft. to 17 ft. while sampling and between 0.5 ft. to 16.5 ft. after completion of the boring. The water in the observation wells were at 12 ft. and 23 ft. in borings B-2 and B-5, respectively, approximately 10 days after completion

of the borings. The majority of the soils encountered in the borings are relatively impervious silty clays, and an extended period of time including additional readings of the water level in the observation wellpoints will be required to accurately determine the position of the permanent water table.

Based upon all information from the subsurface investigation performed, it is estimated that the long term hydrostatic ground water table was located at depths from 13 to 18 ft. below ground surface at the time soil borings were performed. The relatively large range in depth to the ground water table is, for the most part, due to the difference in the topographic relief across the site. It is also possible that a perched water table could exist above the long term hydrostatic water table. Such a condition is formed where infiltration of precipitation or runoff water is retarded by an underlying low permeability silty clay soil. The depth of the perched water table below existing ground surface may vary from 0 ft. to 10 ft.

Fluctuations in the location of the perched water table and permanent ground water table should be anticipated to vary depending upon variations in precipitation, evaporation and surface runoff.

ANALYSIS AND RECOMMENDATIONS

Since plans for the development of the sanitary landfill is in the preliminary stages and the vertical or lateral extent to which this disposal operations will

be carried out are not known at this time, the recommendations and the general comments given below should be considered preliminary in nature. A review by a soil engineer should be made after the plans are finalized.

Based on the results of the six borings performed at the site, it appears that the site conditions are generally favorable for use as a sanitary landfill. The low permeability silty clay soils encountered at the site should serve as a suitable barrier against the loss of leachate which will develop in the refuse placed at the proposed site. It is anticipated that the site will be provided with a leachate collection system which will be located below the refuse. Since the leachate collection system may be located below the level of the permanent hydrostatic ground water table, some seepage may occur in the landfill from the sides and bottom casing the amount of leachate generated to be slightly greater than would be expected if the base of the landfill were above the water table.

All topsoil stripped from the area should be stockpiled for future replacement over the final cover.

Where granular, more permeable soils are encountered in excavations which will receive refuse, it is recommended that they be overexcavated for a minimum of 3 ft. measured perpendicularly to the sides of the excavation. The overexcavated zone should be replaced with a properly compacted, low permeability silty clay backfill, placed in lifts not exceeding 9 in. in loose thickness and

compacted to a minimum of 95% of maximum density obtained in accordance with ASTM Specification D 1557 (Modified Proctor). Careful inspection should be carried out during the excavation operation to assure that all permeable layers located within the zone of the refuse disposal are located and overexcavated to the depth recommended above.

It is recommended that the landfill area be provided with a leachate collection system located on the natural clay or compacted silty clay underliner. The planning of the landfill operation should be carried out so that the drain tile system will always be provided with a suitable outlet for the discharge of the leachate. The base of the area to receive the refuse should be sloped so that the drainage toward the leachate collection system is promoted. The type of drain pipe used should be one resistant to deterioration under chemical attack from leachate. The drain tiles should be surrounded by a minimum of 6 in. of well graded granular filter material compatible with the natural surrounding soil and the type of openings used in the drain tiles. The drainage system should feed to a facility where the leachate can be treated for proper discharge.

Since some of the refuse and the leachate collection system may be located below the long term hydrostatic ground water table, some ground water seepage into the refuse and the drain system located below the water table level should be anticipated. For this reason, the quantity of leachate which would have to be handled by the treatment facility may be greater than that which would

occur if the refuse and the drain system were located above the permanent water table. The quantity of leachate could be minimized by assuring that the underdrainage system is placed on a continuous natural or compacted silty clay underliner.

The drainage system should be carefully installed so that proper functioning is assured. The major quantity of leachate can be expected to develop after completion of the placement of refuse at the site. For this reason, the leachate collection system has to be durable enough to remain in operation for a substantial amount of time after completion of the landfill operation.

Regarding the placement of the refuse in the landfill, it is recommended that each days refuse be covered by a minimum of 6 to 8 in. of compacted inorganic soil. It is anticipated that the site soils will be used for this purpose. Granular soils could be used for daily cover. However, increased infiltration may occur through the daily cover before completion of the landfill. Upon achieving final grade, it is recommended that a minimum of 2 ft. of compacted inorganic silty clay material be placed over the refuse to provide a final cover. This final cover should be graded so that proper drainage away from the refuse disposal area is provided, and should be provided with additional layer of topsoil which would aid in the growth of vegetation on the cover material and thereby reduce the possibility of erosion of the cover. In any event, where erosion of cover material does occur or settlement of the cover material does occur due to the decomposition or densification of the refuse, prompt or immediate maintenance of the cover material should be provided to minimize this condition.

Provisions should be made for the maintenance of the leachate collection system and treatment facilities at the site after completion of the landfill operations since leachate will continue to develop for a significant amount of time following completion of the operations.

Analysis of the quality of the ground water performed during this investigation will be submitted upon completion. In order to provide a basis for comparison, during and after completion of the landfill operation, quality of the ground water should be performed periodically.

The generation of gases within the covered landfill will occur as decomposition of the refuse takes place. A system of vents should be provided to allow this gas to escape to the atmosphere without lateral migration off the site.

Regarding construction and operation of the sanitary landfill, it would be expected that some problems may occur due to the infiltration of seepage or runoff water at the base of the excavation to receive the refuse. All seepage water which does not come in contact with the refuse should be promptly removed by standard sump pit and pump procedures. Proper equipment should be available at the site at all times during the placing of the cover material so that this material can be installed promptly and according to the recommendations given above.

It is recommended that all site preparation work, including removal of unsuitable granular inclusions, placement and compaction of silty underliner fill, be

Inspected and tested by an experienced soil engineer to assure conformance with the project plans and specifications.

GENERAL QUALIFICATIONS

The analysis and recommendations contained in this report are based upon results of the six soil borings performed at the site, the results of the laboratory tests and on preliminary information available regarding the scope of the project. Although generalizations have been made herein regarding soil conditions, the specific information reported is valid only at the location of the soil borings, and variations may occur at intermediate locations. The nature and extent of these variations may not become evident until operation of the landfill is in progress. If significant variations then become evident, it will be necessary for a re-evaluation of the recommendations contained in this report.

We would be pleased to review the final plans and specifications for the project so that we may comment on the effect of soil conditions on the design and specifications.

This report has been prepared in order to aid the engineer in the evaluation of the site and to assist in the final design and operation of this project. The scope is limited to the specific project and location described herein, and represent our understanding of the significant aspects relevant to soil

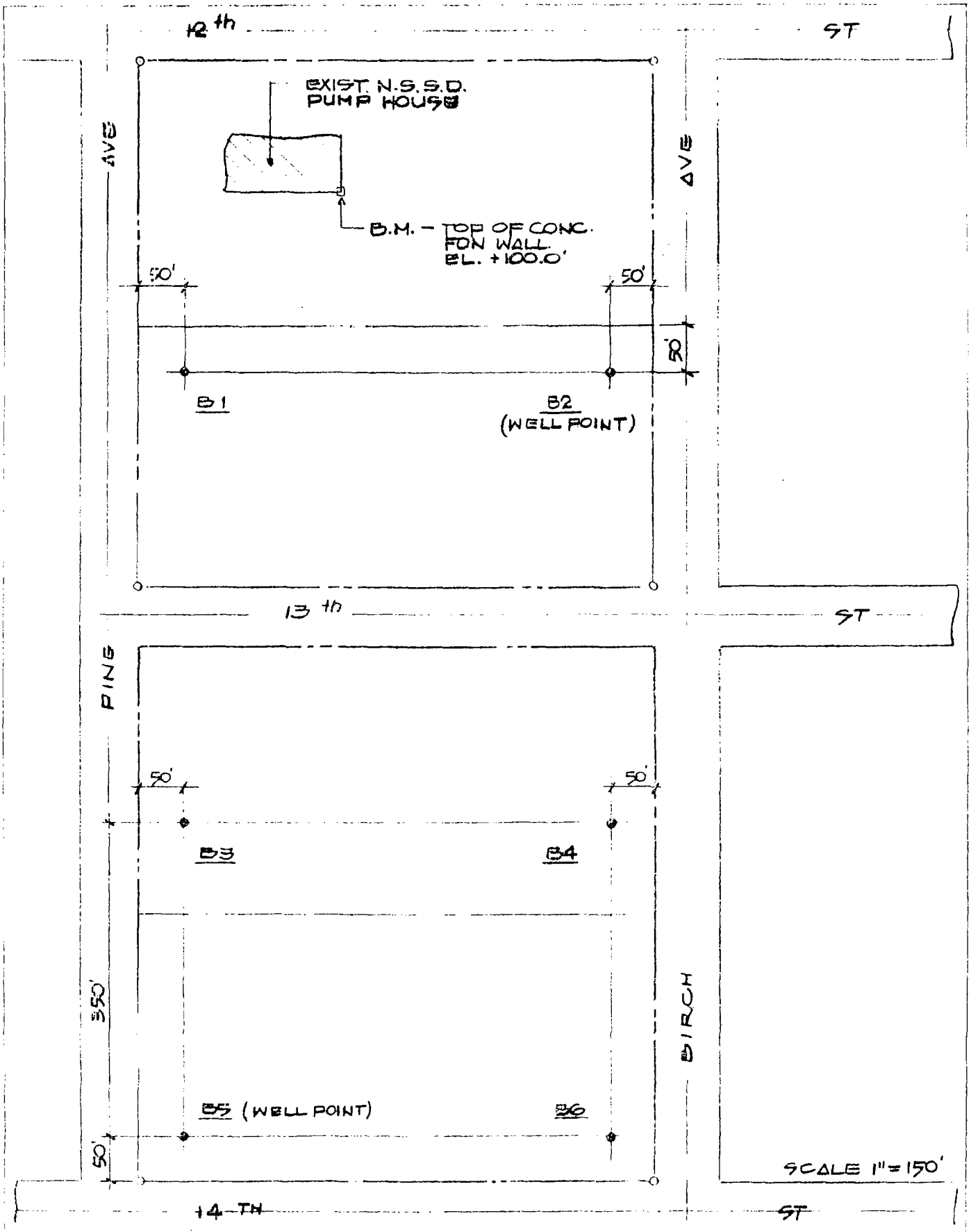
and waste disposal considerations. If there are any differences in the location and/or design features, we should be informed so that we might have the opportunity to revise our conclusions and recommendations, where appropriate. If additional soil borings or testing are necessary, we would be pleased to be of further assistance to you in providing any of the services.

APPENDIX

1. Location Diagram and Topographic Map
2. General Notes
3. Boring Logs
4. Permeability Test Results
5. Grain Size Distribution Curves
6. Cation Exchange Capacity
7. ASTM Specifications

   D 1586-67
   D 1587-67

8. Unified Soil Classification System
9. Soil Characteristics Pertinent to Roads and Airfields

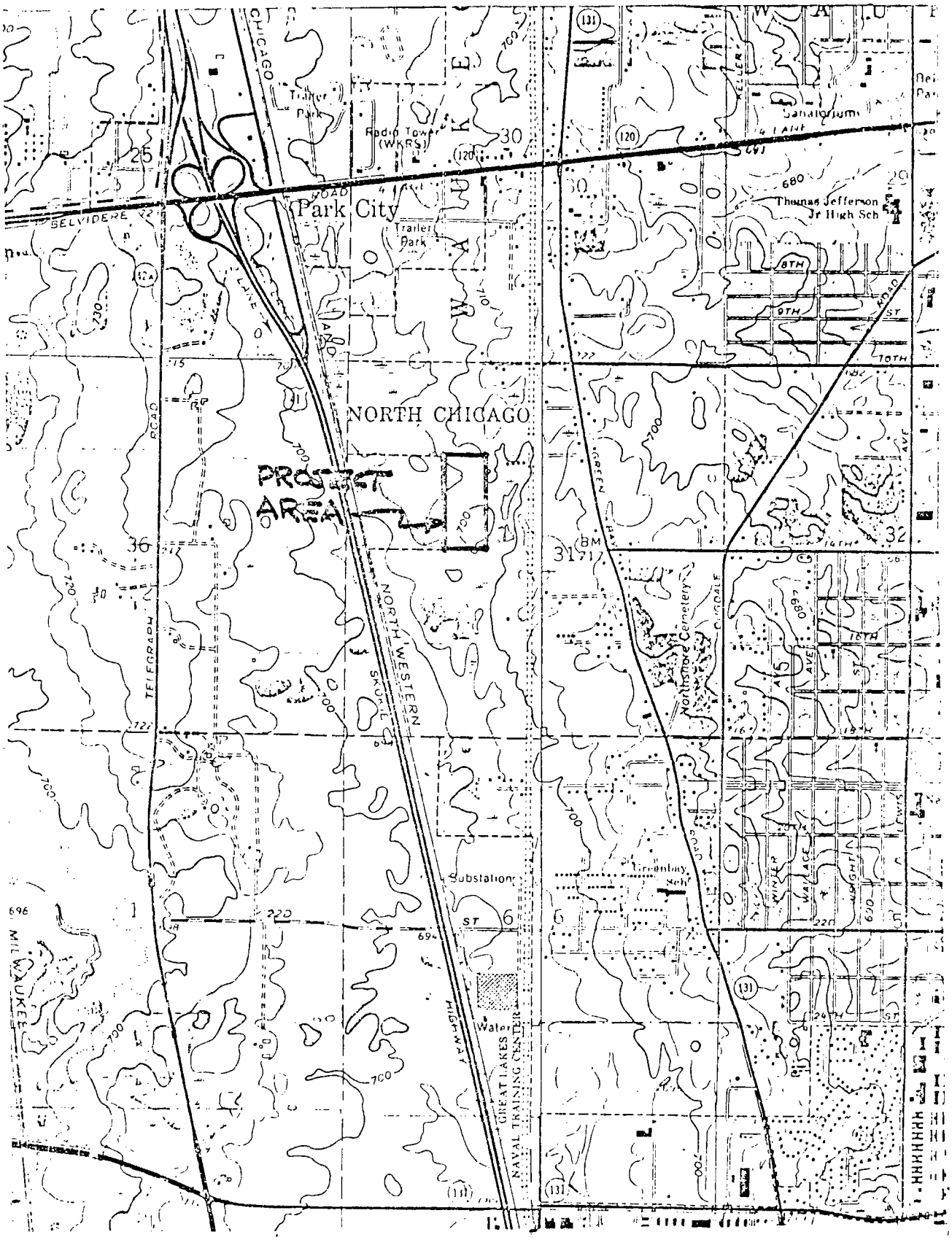


SOIL BORING LOCATION DIAGRAM
PROPOSED SANITARY LANDFILL SITE
NORTH CHICAGO ILLINOIS

SOIL TESTING SERVICES, INC.
111 PFINGSTEN ROAD
NORTHBROOK ILLINOIS 60062

MP	KKS	10.5.1973	14043-E

FORM LD D



Contour Interval: 10 FT. Scale: 1" = 2000 FT.

TOPOGRAPHIC MAP OF THE AREA

SOIL TESTING SERVICES, INC.
111 PFINGSTEN ROAD
NORTHBROOK ILLINOIS

14043-B

FORM LE. D

OWNER: Browning-Ferris Industries	LOG OF BORING NUMBER: B-1
PROJECT NAME: Proposed Sanitary Landfill	ARCHITECT-ENGINEER: Civil Engineer: Tomlin Associates
SITE LOCATION: Pine Ave. & 12th Street, North Chicago, Illinois	

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1 2 3 4 5)

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %

(10 20 30 40 50)

STANDARD PENETRATION BLOWS/FT. (10 20 30 40 50)

ELEVATION / DEPTH	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³
					SURFACE ELEVATION +690.5	
	1	ST			Silty clayey topsoil, trace roots - black (OL-OH)	
	1A	PA			Silty clay, trace roots, sand and gravel - brown and gray - tough (CL-CH)	
5.0	2	ST				
	3	ST			Silty, clayey, fine to medium sand, trace gravel - gray-brown - dense (estimated) - wet (SM-SC)	
	4	SS				
	4A	PA			Silt, trace clay - brown & slightly gray - dense - wet (ML)	
10.0	5	SS			Clayey silt - gray - dense - wet (ML-MH)	
		PA				
15.0	6	SS			Silty fine sand, trace gravel - gray - dense - wet (ML-SM)	
		PA				
20.0	7	ST			Silty clay, trace sand and gravel - gray - very tough (CL)	119
		PA				
25.0	8	ST			Silty clay, trace sand and gravel - gray - tough (CL)	
26.5					End of Boring	

77.1

16/6"

*Calibrated Penetrometer

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDRY LINES BETWEEN SOIL TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

WL 5.5'	WS or WD	BORING STARTED 10-3-73	SOIL TESTING SERVICES, INC. 111 PFINGSTEN ROAD NORTHBROOK ILLINOIS 60062
WL BCR	ACR	BORING COMPLETED 10-3-73	
WL 1.0' A.B.		RIG Auger FOREMAN DH	APPROVED BY KS STS JOB NO. 14043-B

OWNER: Browning-Ferris Industries	LOG OF BORING NUMBER: B-2
PROJECT NAME: Proposed Sanitary Landfill	ARCHITECT-ENGINEER: Civil Engineer: Tomlin Associates
SITE LOCATION: Pine Ave. & 12th Street, North Chicago, Illinois	

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1 2 3 4 5)

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT % (10 20 30 40 50)

STANDARD PENETRATION BLOWS/FT. (10 20 30 40 50)

SURFACE ELEVATION +701.1

ELEVATION / DEPTH	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³
	1	ST			Silty clayey topsoil, trace roots, sand & gravel - brown to dk.gray (OL-OH)	
	1A				Silty clay, trace to some sand, trace roots & gravel - brown - very tough (CL)	
	2	ST			Silty clay with silt seams, trace sand and gravel - brown & slightly gray - hard (CL)	
5.0	3	ST				123
	4	ST			Fine sand, trace silt and gravel - brown - dense (estimated) - moist (SP)	
10.0	5	ST			Silty clay, trace sand and gravel - gray - very tough (CL)	126
15.0	6	ST				140
20.0	7	ST			Silty clay, trace gravel and shale - gray - hard (CL)	131
	7A				Fine to medium sand, trace silt, gravel and clay lumps - gray - dense (estimated) - moist (SP)	
25.0	8	ST			Silty clay, trace sand with silt seams - gray - very tough (CL)	
30.0	9	ST			Silty clay, trace sand and gravel - gray - very tough (CL)	124
32.5						

(Contd. on Sheet 2)

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

OWNER: Browning-Ferris Industries	LOG OF BORING NUMBER: B-2 (Contd.)
PROJECT NAME: Proposed Sanitary Landfill	ARCHITECT-ENGINEER: Civil Engineer: Tomlin Associates
SITE LOCATION: Pine Ave. & 12th Street, North Chicago, Illinois	

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2}: 1 2 3 4 5

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT.: 10 20 30 40 50

ELEVATION / DEPTH	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.^{3}
					SURFACE ELEVATION	
					(Contd. from Sheet 1)	
32.5						
		PA			Silty clay, trace sand and gravel - gray - very tough	
35.0						
	10	ST			(CL)	119
37.0						
					End of Boring	
					Wellpoint installed to 35'.	

*Calibrated Penetrometer

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDRY LINES BETWEEN SOIL TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

WL 17' WS or WD	BORING STARTED 10-1-73	SOIL TESTING SERVICES, INC. 111 PFINGSTEN ROAD NORTHBROOK ILLINOIS 60062	
WL BCR ACR	BORING COMPLETED 10-1-73		
WL 16' A.B.	RIG Auger FOREMAN DH	APPROVED BY KS	STS JOB NO. 14043-B

BL.:1

OWNER	Browning-Ferris Industries	LOG OF BORING NUMBER	B-3
PROJECT NAME	Proposed Sanitary Landfill	ARCHITECT-ENGINEER	Civil Engineer: Tomlin Associates
SITE LOCATION	Pine Ave. & 12th Street North Chicago, Illinois		

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1 2 3 4 5)

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT % (10 20 30 40 50)

STANDARD PENETRATION BLOWS/FT. (10 20 30 40 50)

ELEVATION / DEPTH	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³
					SURFACE ELEVATION +692.6	
	1	ST			Silty clayey topsoil, trace roots - black (OL-OH)	
		PA				
	2	ST			Silty clay, trace roots, sand and gravel - gray & slightly brown - stiff (CL-CH)	108
5.0		PA				
	3	ST			Silty, fine to medium sand, trace to some gravel - gray-brown - med. dense(est.)-moist to wet (SM)	
		PA				
	4	ST			Clayey silt - gray and brown - very tough - wet (ML-CL)	110
11.0		PA				
	5	ST			Silt, trace clay - gray - very tough - dense - wet (ML)	103
		PA				
15.0					Silty clay, trace sand and gravel - gray - tough	
	6	ST			(CL)	
		PA				
20.5						
	7	ST			Silty clay, trace sand and gravel - gray - very tough (CL)	123
		PA				
25.0						
	8	ST				
27.0					End of Boring	

639

*Calibrated Penetrometer

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDRY LINES BETWEEN SOIL TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

WL 3'	WS or WD	BORING STARTED 10-2-73	SOIL TESTING SERVICES, INC.
WL	BCR ACR	BORING COMPLETED 10-2-73	111 PFINGSTEN ROAD NORTHBROOK ILLINOIS 60062
WL 1.5' A.B.		RIG Auger FOREMAN DH	APPROVED BY KS — STS JOB NO. 14043-B

BL:1

OWNER: Browning-Ferris Industries	LOG OF BORING NUMBER: B-4
PROJECT NAME: Proposed Sanitary Landfill	ARCHITECT-ENGINEER: Civil Engineer: Tomlin Associates
SITE LOCATION: Pine Ave. & 12th Street, North Chicago, Illinois	

SURFACE ELEVATION +705.5 "A" (See Sheet 2)

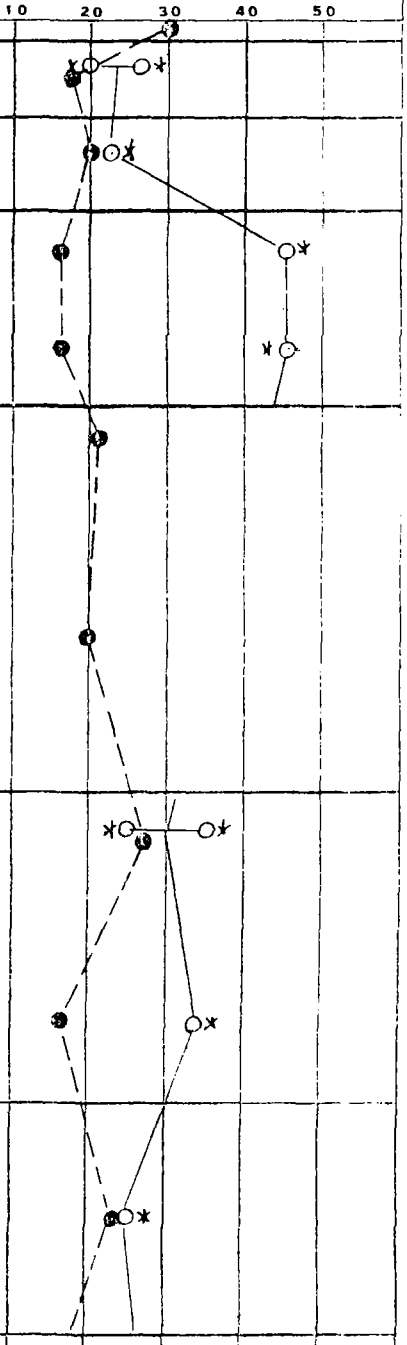
ELEVATION / DEPTH	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³
	1	ST				
	1A	PA			Silty clay, trace sand & gravel - brown - very tough (CL)	
	2	ST			Silty clay, trace to some sand and gravel, with sand seams - brown and slightly gray - very tough (CL)	
5.0		PA				
	3	ST			Silty clay, trace sand and gravel, with sand seams - brown and slightly gray - hard (CL)	123
	4	PA				
10.0						
	5	ST			Silt, trace sand and clay, with layers of sand and gravel between 17'-20' - gray - dense (est.) - moist to wet (ML)	112
		PA				
15.0						
	6	ST				112
		PA				
20.0						
	7	ST			Silty clay, trace sand and gravel with silt seams - gray - very tough (CL)	101
		PA				
25.0						
	8	ST				119
		PA				
30.0					Silty clay, trace sand - gray - very tough (CL-CH)	
	9	ST				104
		PA				
34.0						

(Contd. on Sheet 2)

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1 2 3 4 5)

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT % (10 20 30 40 50)

STANDARD PENETRATION BLOWS/FT. (10 20 30 40 50)



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDRY LINES BETWEEN SOIL TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

OWNER: Browning-Ferris Industries	LOG OF BORING NUMBER: B-4 (Contd.)
PROJECT NAME: Proposed Sanitary Landfill	ARCHITECT-ENGINEER: Civil Engineer: Tomlin Associates
SITE LOCATION: Pine Ave. & 12th Street, North Chicago, Illinois	

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2}: 1 2 3 4 5

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT.: 10 20 30 40 50

ELEVATION / DEPTH	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.^{3}
					(Contd. from Sheet 1)	
34.0 / 35.0	10	PA / S			Silty clay, trace sand, with seams of sand & silt - gray - very tough (CL)	123
40.0 / 42.0	11	PA / S			Silty clay, trace sand and gravel (disturbed sample) - gray - very tough (CL)	
					End of Boring	

*Calibrated Penetrometer

"A": Silty and clayey topsoil, trace roots - dark brown & dark gray (OL-OH)

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDRY LINES BETWEEN SOIL TYPES. IN-SITU, THE TRANSITION MAY BE GRADUAL.

WL 17' WS or WD	BORING STARTED 10-1-73	SOIL TESTING SERVICES, INC. 111 PFINGSTEN ROAD NORTHBROOK ILLINOIS 60062	
WL BCR ACR	BORING COMPLETED 10-1-73		
WL 16.5' A.B.	RIG Auger FOREMAN DH	APPROVED BY KS	STS JOB NO. 14043-B

BL-1

OWNER: Browning-Ferris Industries	LOG OF BORING NUMBER: B-5
PROJECT NAME: Proposed Sanitary Landfill	ARCHITECT-ENGINEER: Civil Engineer: Tomlin Associates
SITE LOCATION: Pine Ave. & 12th Street, North Chicago, Illinois	

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1 2 3 4 5)

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT % (10 20 30 40 50)

STANDARD PENETRATION BLOWS/FT. (10 20 30 40 50)

ELEVATION / DEPTH	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³
					SURFACE ELEVATION +693.9	
	1	ST			Silty & clayey topsoil, trace roots - black (OL-OH)	
		PA				
	2	ST			Silty clay, trace sand & gravel and clayey sand, trace to some gravel - brown & gray (CL-CH & SC)	103
5.0		PA				
	3	SS			Silty fine sand, trace clay with silt seams - gray - dense (estimated) - wet (SM)	
	3A					107
		PA				
	4	SS			Silt, trace sand and clay with sand seams - gray - tough - dense - wet (ML)	
10.0		PA				
	5	SS			Clayey silt - gray - medium dense - wet (ML)	
		PA				
15.0	6	ST			Silty clay, trace sand and gravel with layer of fine sand @ 17' - gray - very tough (CL)	121
		PA				
20.0	7	ST			Silty clay, trace sand and gravel with sand seams - gray - very tough (CL)	
		PA				
25.0	8	ST			Silty clay, trace sand and gravel - gray - very tough (CL)	114
		PA				
30.0	9	ST				114
32.0					End of Boring. Wellpoint installed to 30'. *Calibrated Penetrometer	

69.6

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDRY LINES BETWEEN SOIL TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

WL 1.0' WS or WD	BORING STARTED 10-2-73	SOIL TESTING SERVICES, INC.	
WL BCR ACR	BORING COMPLETED 10-2-73	111 PFINGSTEN ROAD NORTHBROOK ILLINOIS 60062	
WL 0.5' A.B.	RIG Auger FOREMAN DH	APPROVED BY KS	STS JOB NO. 14043-B

BL:1

OWNER	Browning-Ferris Industries	LOG OF BORING NUMBER	B-6
PROJECT NAME	Proposed Sanitary Landfill	ARCHITECT-ENGINEER	Civil Engineer: Tomlin Associates
SITE LOCATION	Pine Ave. & 12th Street North Chicago, Illinois		

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1 2 3 4 5)

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT % (10 20 30 40 50)

STANDARD PENETRATION BLOWS/FT (10 20 30 40 50)

ELEVATION / DEPTH	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³
					SURFACE ELEVATION +698.0	
	1	ST			Silty clayey topsoil, trace roots - dk. brown (OL-OH)	
	1A	PA			Silty clay, trace roots, sand and gravel - brown - hard (CL)	
	2	ST				
5.0		PA				
	3	ST			Silty clay, trace sand and gravel - brown and slightly gray - tough to very tough (CL-CH)	105
		PA				
	4	ST				114
	4A	PA			Silt, trace clay with sand seams - light brown - very tough - medium dense - moist to wet (ML)	114
10.0	5	ST				
	5A				Silty clay, trace sand and gravel, with sand seams - brown - very tough (CL)	
		PA			Silt, trace clay - light gray - dense (estimated) - wet (ML)	
15.0	6	ST				
	6A				Fine sand, trace to some silt, trace gravel - gray - dense (estimated) - moist to wet (SP-SM)	
		PA			Silty and clayey sand, trace gravel - gray - dense (estimated) - wet (SM-SC)	
20.0	7	ST				
		PA				
25.0	8	ST			Silty clay, trace sand and gravel - gray - very tough (CL)	
		PA			Silty clay, trace sand and gravel - gray - tough (CL)	
30.0	9	ST				123
32.5		PA				

(Contd. on Sheet 2)

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDRY LINES BETWEEN SOIL TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

OWNER: Browning-Ferris Industries	LOG OF BORING NUMBER: B-6 (Contd.)
PROJECT NAME: Proposed Sanitary Landfill	ARCHITECT-ENGINEER: Civil Engineer: Tomlin Associates
SITE LOCATION: Pine Ave. & 12th Street, North Chicago, Illinois	

ELEVATION / DEPTH	SAMPLE NO	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS./FT.³
					(Contd. from Sheet 1)	
32.5						
		PA			Silty clay, trace sand and gravel - gray - tough (CL)	
35.0	10	ST				
		PA			Silt, trace sand and gravel, with layer of clay - moist to wet - gray - dense (ML)	
40.0	11	ST				127
42.0					End of Boring	

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² (1 2 3 4 5)

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT % (10 20 30 40 50)

STANDARD PENETRATION BLOWS/FT. (10 20 30 40 50)

*Calibrated Penetrometer

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDRY LINES BETWEEN SOIL TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL

WL 12' WS or WD	BORING STARTED 10-2-73	SOIL TESTING SERVICES, INC.	
WL BCR ACR	BORING COMPLETED 10-2-73	111 PFINGSTEN ROAD	
WL Wet cave-in @ 9.5' A.B.	RIG Auger FOREMAN DH	NORTHBROOK ILLINOIS 60062	
		APPROVED BY KS	STS JOB NO. 14043-B

BL:1

Proposed Sanitary Landfill
Pine Ave. & 12th St.
North Chicago, Illinois

STS Job No. 14048-B
Date: 10-16-73
By: CHC

Summary of Laboratory Soil Testing Results

Boring No.	Sample No.	Depth Ft.	Grain Size	Constant Head Permeability cm/sec.
1	7	20 - 22	*	5.5×10^{-7}
2	5	10 - 12	*	3.6×10^{-7}
2	7A	21 - 22	*	
3	6	15 - 17		2.1×10^{-7}
4	8	25 - 27		9.2×10^{-7}
5	6	15 - 17	*	6.4×10^{-7}
6	8	25 - 27	*	8.3×10^{-7}
6	11	40 - 42	*	7.9×10^{-7}

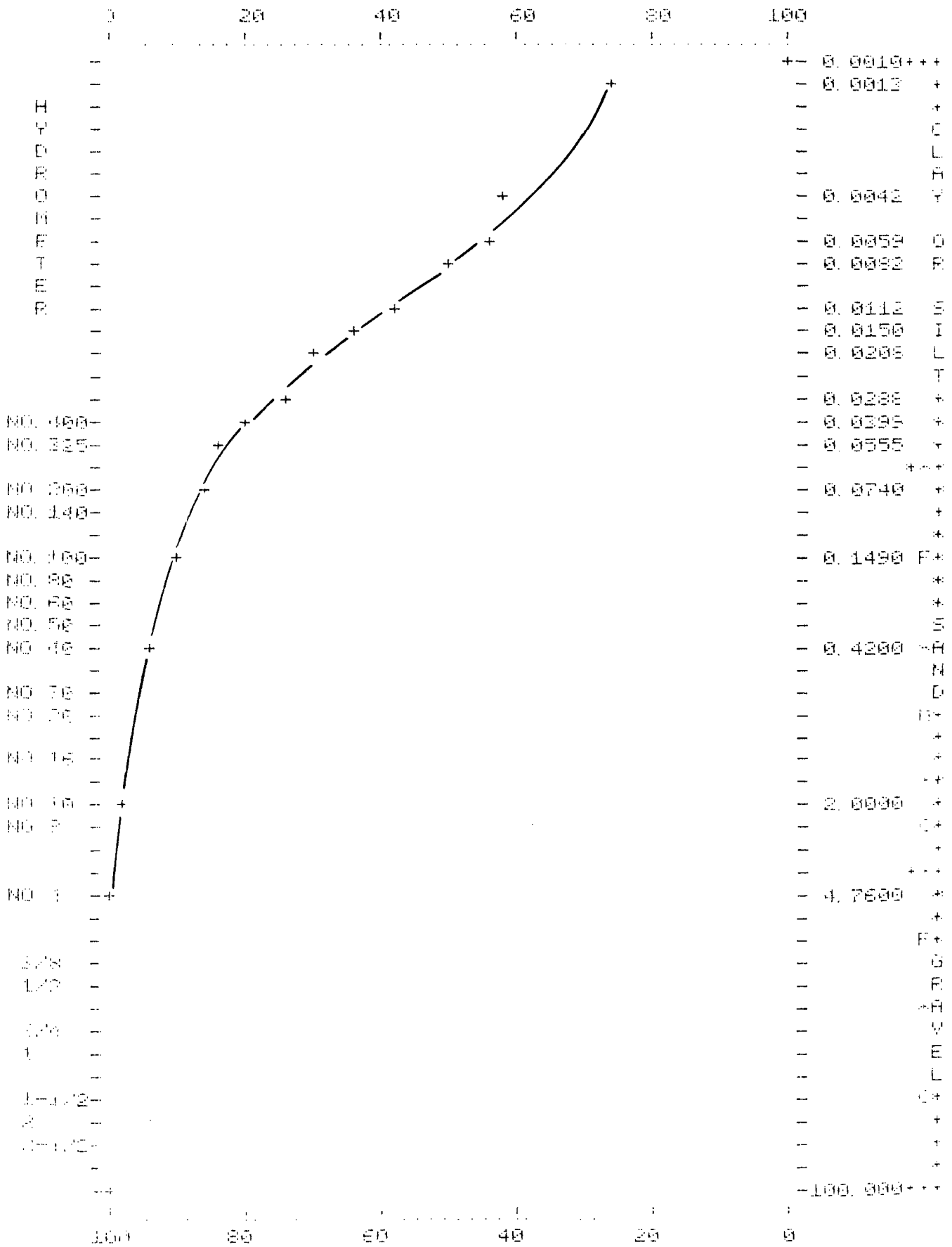
*See enclosed.

Note: 10 psi of constant head was employed for the permeability.

1 psi = 2.27 ft. of water column

1 cm/sec. = 1×10^{6} ft./year

SOIL TESTING SERVICES, INC. SIEVE AND HYDROMETER ANALYSIS
STS #140438 SAMPLE ID. B-1 7



SOIL TESTING SERVICES, INC. SIEVE AND HYDROMETER ANALYSIS
STS #14043B SAMPLE ID: 2 5

U.S. STD SIEVE SIZES

PER CENT COARSER BY WEIGHT

0 20 40 60 80 100

HYDROMETER

NO. 200
NO. 325
NO. 400
NO. 440
NO. 100
NO. 80
NO. 60
NO. 50
NO. 40
NO. 30
NO. 20
NO. 16
NO. 8
NO. 4
3/8"
1/2"
3/4"
1"
1-1/2"
2"
2-1/2"

0.0010
0.0014
0.0042
0.0060
0.0084
0.0117
0.0158
0.0219
0.0303
0.0424
0.0598
0.0740
0.1490
0.4200
2.0000
4.7600

GRAIN SIZE IN MM

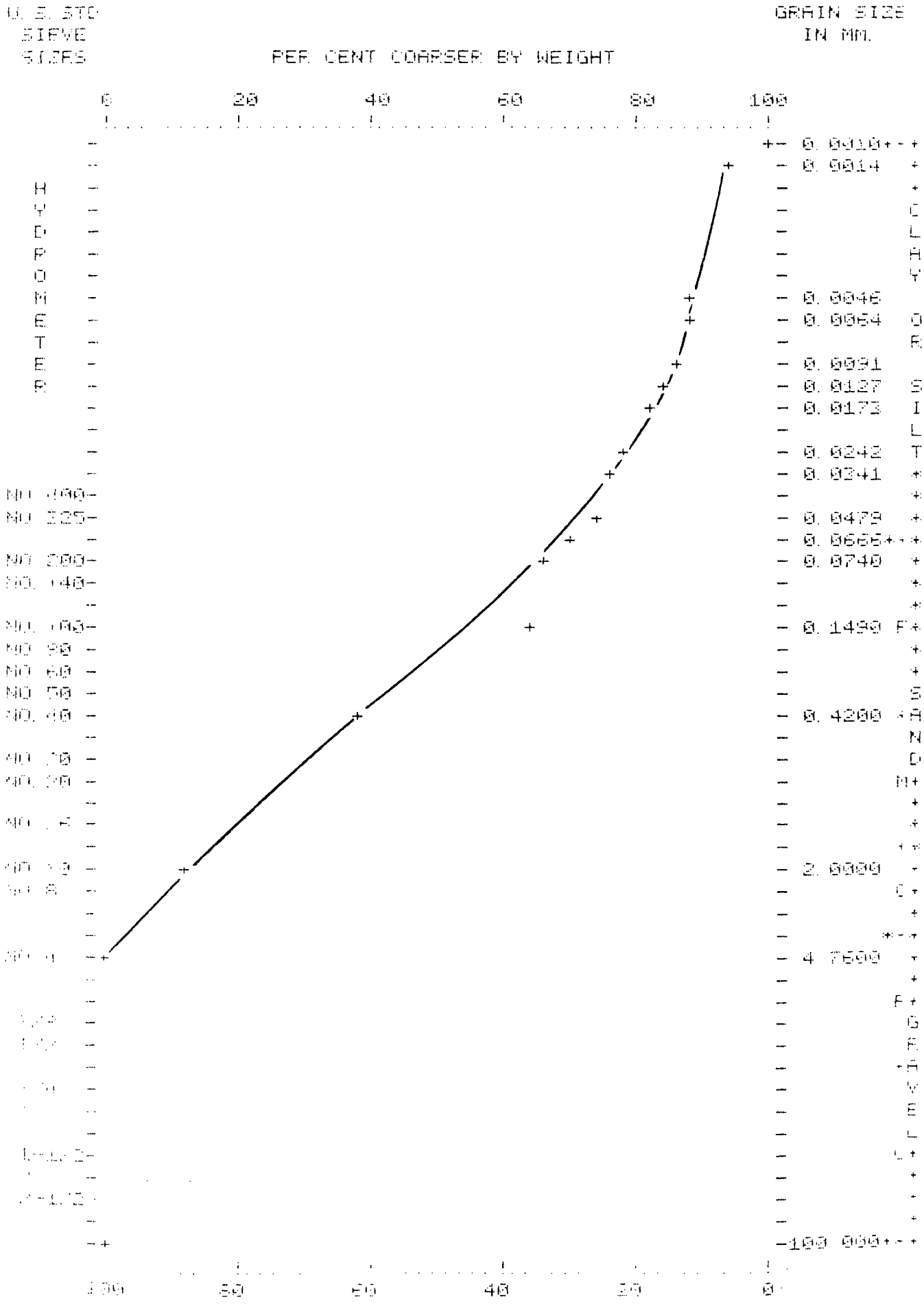
CLAY
SILT
FINE SAND
MEDIUM SAND
COARSE SAND
FINE GRAVEL
COARSE GRAVEL

100 80 60 40 20 0

PER CENT FINER BY WEIGHT

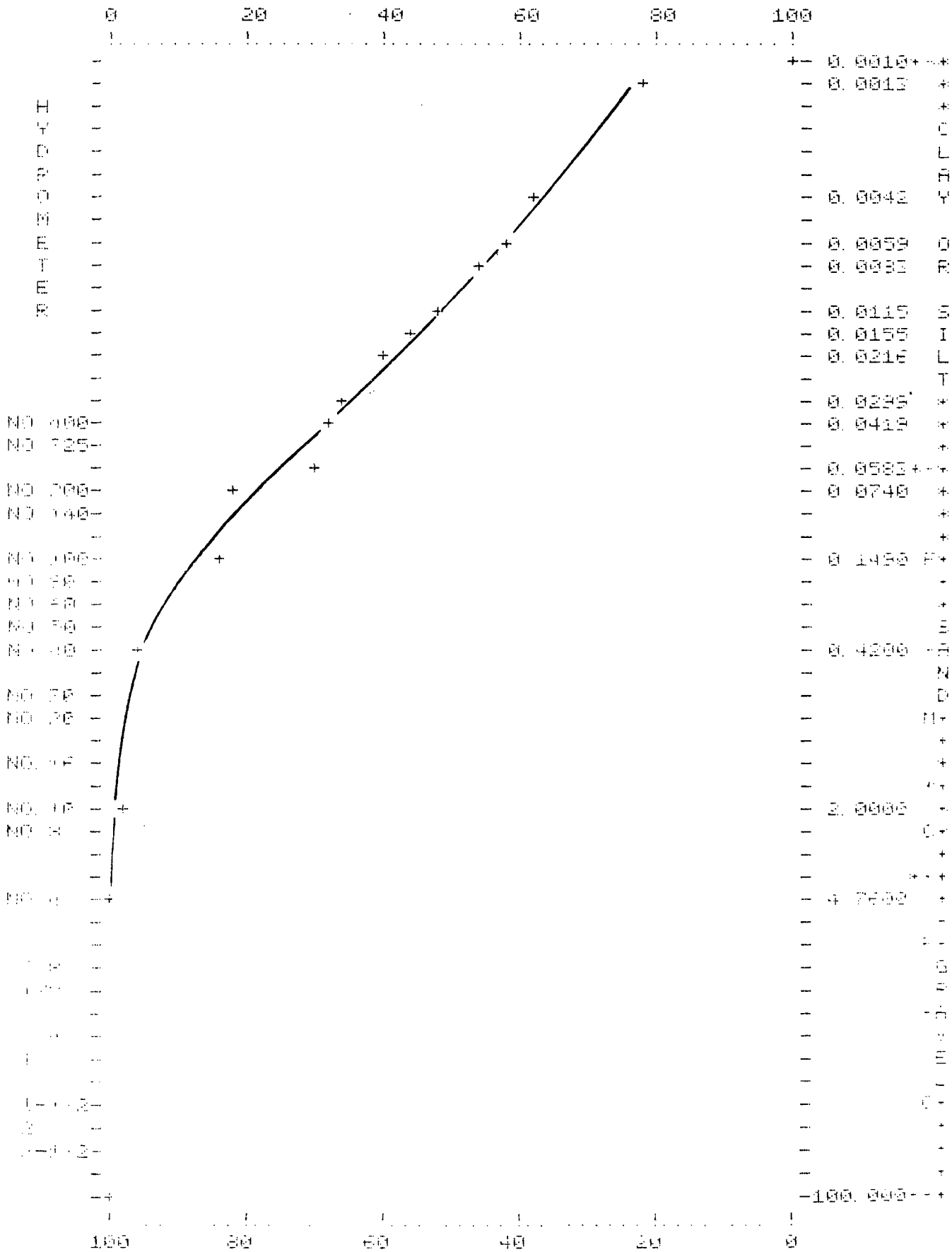
SOIL TESTING SERVICES, INC. SIEVE AND HYDROMETER ANALYSIS

STS #140438 SAMPLE ID: 2 PA



SOIL TESTING SERVICES, INC. SIEVE AND HYDROMETER ANALYSIS
STS #14043B SAMPLE ID: B-5 6

U.S. STD SIEVE SIZES — PER CENT COARSER BY WEIGHT — GRAIN SIZE IN MM.



PER CENT FINER BY WEIGHT

SOIL TESTING SERVICES, INC.
STS #140438

SIEVE AND HYDROMETER ANALYSIS

SAMPLE ID: B-6 11

U.S. STD SIEVE SIZES

PER CENT COARSER BY WEIGHT

0 20 40 60 80 100

NO 400
NO 325
NO 200
NO 140
NO 100
NO. 80
NO. 60
NO 50
NO 40
NO 30
NO 20
NO 16
NO 10
NO 8
NO 4

GRAIN SIZE IN MM.

0.0010
0.0013
0.0042
0.0059
0.0082
0.0114
0.0154
0.0213
0.0296
0.0413
0.0589
0.0740
0.1490
0.4200
2.0000
4.7500
-100.000

100 80 60 40 20 0

PER CENT FINER BY WEIGHT

SOIL TESTING SERVICES, INC.
FTS #140438

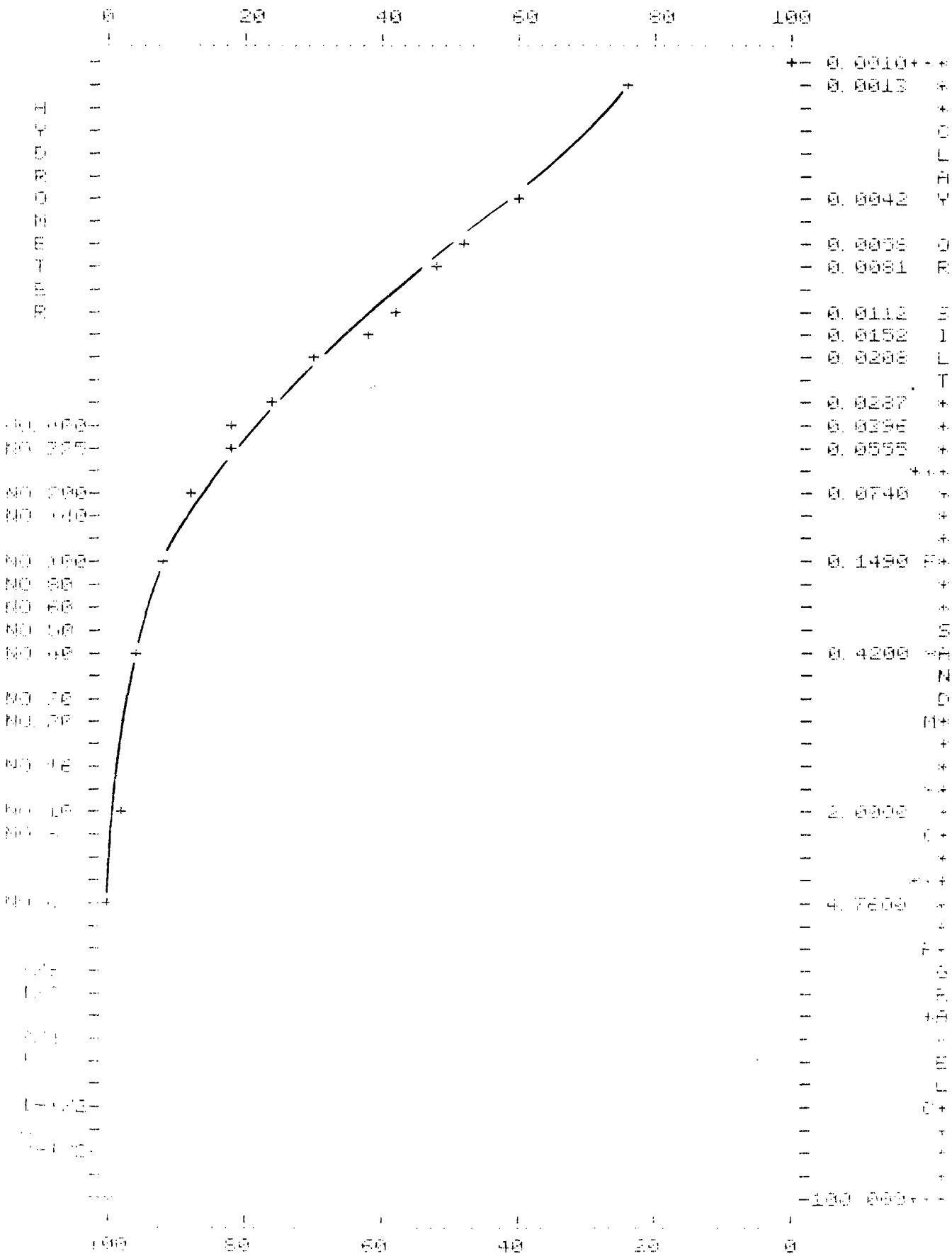
SIEVE AND HYDROMETER ANALYSIS

SAMPLE ID: B-6 S

U.S. STD SIEVE SIZES

PER CENT COARSER BY WEIGHT

GRAIN SIZE IN MM



PER CENT FINER BY WEIGHT

4 Nov 1973
RGH Jr

Cation Exchange Capacity (CEC)

STS # 14043-B

Soil sample: B-5 S-6 15'-17'

Method: American Society of Agronomy, Method 57-2, Cation Exchange Capacity by Ammonium Saturation (Ammonium Acetate Solution, 1 MOLAR, pH = 7.0 ± 0.1)

CEC referenced to weight of soil as received:
4.94 milliequivalents per 100g. soil

CEC referenced to weight of soil as dried at 105°C:
5.64 milliequivalents per 100g dry soil

WC = 14.3%

Note: Addition of hydrochloric acid to a portion of soil sample caused evolution of considerable amounts of gas, probably CO_2, and indicates appreciable limestone and/or dolomite content in sample.